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TUDY OF TRAFFIC DISTRIBUTION FACILITIES FOR SECOND BAY CROSSING

DECEMBER 1946

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S E C O N D B A Y C R O S S I N G S T U D Y

A Joint Report on
Minimum Traffic Distribution Facilities
Required at the San Francisco Terminus

Department of Public Works
and
City Planning Commission

December 1946

C I T Y A N D C O U N T Y O F S A N F R A N C I S C O

CITY AND COUNTY OF SAN FRANCISCO

City Planning Commission — Department of Public Works

December 2, 1946

LETTER OF TRANSMITTAL

Mr. F. W. Panhorst
Bridge Engineer
California Division of Highways
Public Works Building
Sacramento, California

Dear Mr. Panhorst:

We are transmitting herewith a brief report on the facilities which would be necessary in San Francisco to provide adequate distribution of vehicular traffic from a new Bay Bridge terminal in each of five possible locations on the easterly margin of this city. The report is submitted in response to a request made by Mr. Stewart Mitchell, your Staff Bridge Engineer, at the time of his visit to the office of Mr. T. A. Brooks, Chief Administrative Officer, on October 17, 1946.

The report has been prepared jointly by the City Planning Commission and Department of Public Works. The locations of the required ramps, viaducts, freeways, and street improvements have been determined through the close collaboration of the technical staffs of the two departments. The City Planning Commission has given particular consideration to securing layouts which would conform with the long range requirements of the City's Master Plan. Estimates of cost have been prepared by the Bureau of Engineering of the Department of Public Works.

No consideration has been given in this report to the matter of railway connections to any of the proposed bridge sites although the City, as you know, is on record as favoring a bridge which will accommodate transcontinental trains. It is assumed that studies of railroad connections to existing trackage in San Francisco will be the subject of a separate request from you if information of this kind is desired.

Yours very truly,

H. C. Vensano

H. C. Vensano, Director
Department of Public Works

M. D. Weill, President
City Planning Commission

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C O N T E N T S
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Title Page

Letter of Transmittal

Contents

I Statement of Principles 1

II Study of Five Locations Designated by State

1. Plate 1, North Slope of Telegraph Hill 4
2. Plate 2, South Slope of Telegraph Hill 6
3. Plate 3, Parallel to Present Bridge 8
4. Plate 4, Twenty-Fifth Street 11
5. Candlestick Point 13

III Key Map and Basic Factors for All Locations 14

I STATEMENT OF PRINCIPLES

The studies presented in this report are based on general principles which are applicable to all the proposed locations of the San Francisco terminus of the proposed second Bay crossing. Below is a statement of these essential principles.

1. There must be enough outlets from the bridge structure so that the total vehicles-per-hour receiving capacity of the city street lanes into which the incoming traffic is delivered equals or exceeds the peak capacity of the westbound lanes of the bridge. Note: This requires several outlet lanes for each lane on the bridge because the capacity of city street lanes is generally less than 50 percent of the capacity of bridge lanes, and because the receiving capacity is further reduced by ordinary local traffic on such streets.

2. Where direct outlets to another freeway can be provided the estimated volume of traffic into such freeway can be deducted in applying the above principle. Note: Such volume would also be limited to the capacity of the freeway in excess of its load from other sources.

3. No outlet is acceptable which is so designed that traffic will immediately encounter an opposing or intersecting flow requiring the use of signals at the exit. Note: Outlets must provide amply for deceleration after leaving the main approach structure and for easy merging of the outflow with a parallel flow of local traffic in order to avoid delay or a backing up of accumulated vehicles on the bridge proper.

4. Principles 1, 2, and 3 apply also, but inversely, to the entrances into the eastbound lanes of the bridge.

5. All new structures necessary for full compliance with the above principles are properly and necessarily part of the bridge itself, and should be included in the cost estimates, with land acquisition considered as a part of the costs. Note: The City must insist upon this point. Anything less would force the City to bear part of the cost of the service supposedly paid for by the toll charge. A "bridge" which does not transfer a vehicle from city street to city street without "internal" delay or choking at the outlets is clearly incomplete.

6. If possible, one or more outlets should lead directly into off-street vehicle storage areas, either open lots

or sites for garage structures (or both), located adjacent to present or proposed local transit lines connecting with the Central Business District.

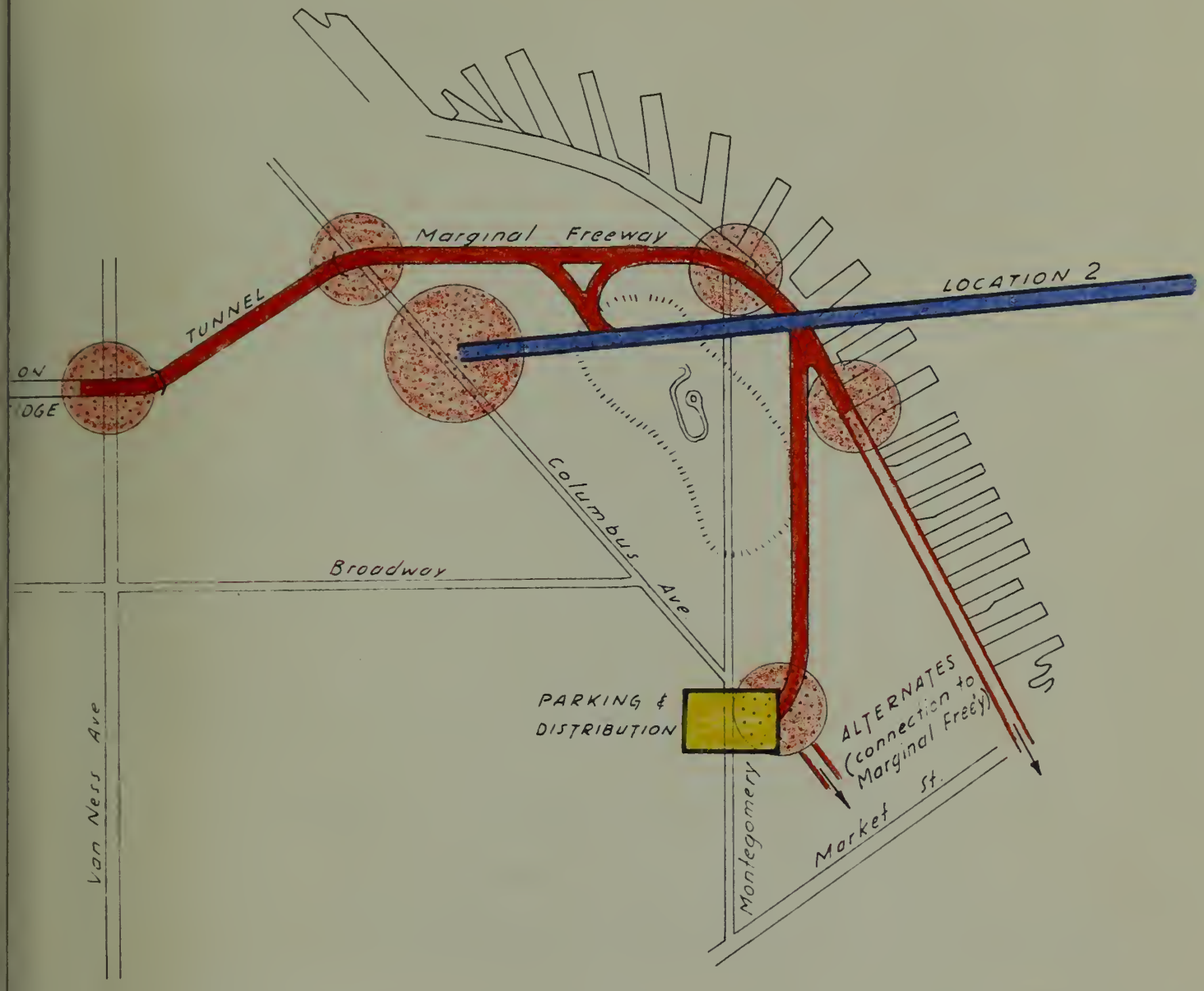
7. Provision must be made on all freeways and upon any bridge hereafter constructed for the operation of transit service buses and for accelerating and decelerating lanes and loading and unloading facilities.

8. The function of The Embarcadero as a distributor to and a collector from the many Central Business District streets must be considered in connection with any new bridge. Provision for full interchange facilities at or near the shoreline is essential as a means of providing, in effect, a multiple series of inlets to and outlets from the Central Business District. Without such provision the avoidance of bottleneck conditions at inland points is impossible.

9. The great value of proposed freeways within the City as distributors of bridge traffic to multiple outlets should be given every possible consideration in the selection of the bridge location.

10. Included in the cost of a second bridge should be the necessary construction for the completion of the present bridge, which, in so far as it falls short of the principles outlined above, is still an unfinished job.

II APPLICATION OF PRINCIPLES TO FIVE LOCATIONS DESIGNATED BY STATE



LOCATION NO. 2

GENERAL LOCATION AND EXTENT OF

ESSENTIAL DISTRIBUTION AND PARKING FACILITIES

BRIDGE PROPOSED BY STATE

ESSENTIAL FREEWAYS
ESSENTIAL DISTRIBUTION
ESSENTIAL PARKING

POSSIBLE FUTURE FREEWAYS

DEPARTMENT OF PUBLIC WORKS AND CITY PLANNING COMMISSION OF SAN FRANCISCO

No. 1946

1. PLATE ONE: LOCATION NUMBER 2, NORTH SLOPE OF TELEGRAPH HILL

Plate 1 shows diagrammatically the essential features of the proposed location on the north slope of Telegraph Hill. There are only two existing streets of more than ordinary width leading southward from this area: The Embarcadero and Van Ness Avenue. The bridge structure, therefore, would have to extend directly into these two thoroughfares, and also into Columbus Avenue, which, because of its easy grade and diagonal location, is of more than ordinary importance in this area.

Connections at all three of these points would have to be designed for steady flow in both directions. The connection to Van Ness Avenue would require a tunnel through Russian Hill and a separation of grades at Van Ness Avenue and Lombard Street. Any portion of the bridge structure which thus lies directly along the line of the express route between the Golden Gate Bridge and The Embarcadero should be of sufficient capacity to accommodate the combined local and bridge traffic.

Further, adequate distribution from this bridge location would require an elevated structure leading into a terminal area at least four blocks in size between the present southerly terminus of Columbus Avenue and the Central Business District. This terminal area would provide for parking facilities on a large scale and for ample direct outlets to streets on the east, west, and south. There should also be connections from this viaduct to Broadway.

All of the above facilities, except the garage construction, should be considered as integral parts of the bridge structure.

Cost Estimate - Location Number 2, North of Telegraph Hill

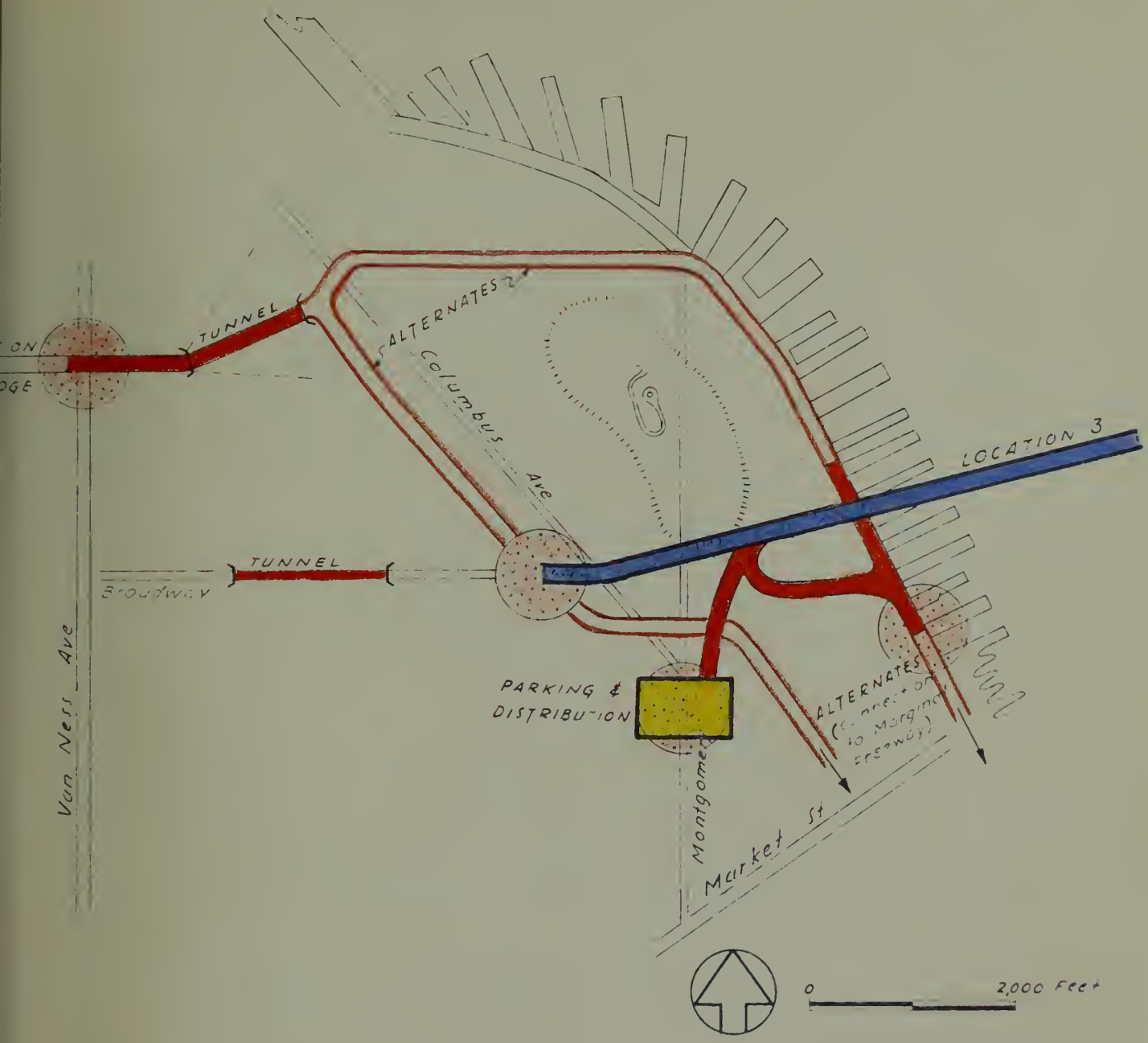
The following estimate of cost is based on a tentative location of the minimum facilities needed to serve the purposes described above:

(a) From Lombard and Franklin Streets to Columbus Avenue and Bay Street (6-lane tunnel, 2,000' long) with connections at Franklin Street and Van Ness Avenue, and including a connection at Columbus Avenue in the vicinity of Bay Street:

Right of Way - $3,500,000
Construction - 7,000,000

Total $10,500,000

Plate 2



LOCATION NO. 3

GENERAL LOCATION AND EXTENT OF

ESSENTIAL DISTRIBUTION AND PARKING FACILITIES

BRIDGE PROPOSED BY STATE

ESSENTIAL FREEWAYS

ESSENTIAL DISTRIBUTION

ESSENTIAL PARKING

POSSIBLE FUTURE FREEWAYS

DEPARTMENT OF PUBLIC WORKS AND CITY PLANNING COMMISSION OF SAN FRANCISCO

2. PLATE TWO: LOCATION NUMBER 3, SOUTH SLOPE OF TELEGRAPH HILL

If the bridge should be brought into San Francisco on the south side of Telegraph Hill, the essential distribution facilities would be as shown on Plate 2. Here too The Embarcadero and Van Ness Avenue are the only streets of extra width leading southward. A tunnel from some point near Columbus Avenue through Russian Hill to Lombard Street and Van Ness Avenue, with a separation of grades at Van Ness Avenue, would be needed. Connections to The Embarcadero should provide for both northbound and southbound traffic and be designed to fit in with future construction plans. Surface routes between the end of the bridge approaches and the easterly end of the tunnel would probably have to be relieved eventually by the construction of expressway facilities along one of the two alternate routes shown on the plate.

Adequate connections between the bridge and surface streets would be required in the vicinity of Broadway and Columbus Avenue, and the Broadway Tunnel would become immediately essential. Street connections east of Columbus Avenue would be also required, as well as an elevated outlet structure leading directly to a terminal area for parking and distribution similar to that described for Location Number 2.

All of the above facilities, except the garage construction, are considered as essential parts of the bridge approach.

Cost Estimate - Location Number 3, South Slope of Telegraph Hill

The following estimate of cost is based on a tentative location of the minimum facilities needed to serve the purposes described above:

(a) From Lombard and Franklin Streets to Columbus Avenue (6-lane tunnel, 2,000' long) with connections to Franklin Street and Columbus Avenue:

Right of Way - $ 3,500,000
Construction - 6,300,000

Total $ 9,800,000

(b) From bridge to connection with Broadway Tunnel, with connections to Stockton and Vallejo Streets and connections to Columbus Avenue and Vallejo Street:

Right of Way - $ 4,000,000
Construction - 1,230,000

Total $ 5,230,000

(c) Connection from bridge to Commercial District (double deck viaduct 3 lanes in each direction) between Montgomery and Sansome Streets to Sacramento Street and parking area, including off and on ramps:

Right of Way - $ 3,400,000
Construction - 1,280,000

Total $ 4,680,000

(d) Connection from above-mentioned viaduct to The Embarcadero with connections north and south thereon:

Right of Way - $ 1,800,000
Construction - 1,342,000

Total $ 3,142,000

(e) Broadway Tunnel (4 lanes, 2,300' long) from Larkin Street to Mason Street:

Right of Way - $ 330,000
Construction - 2,885,000

Total $ 3,215,000

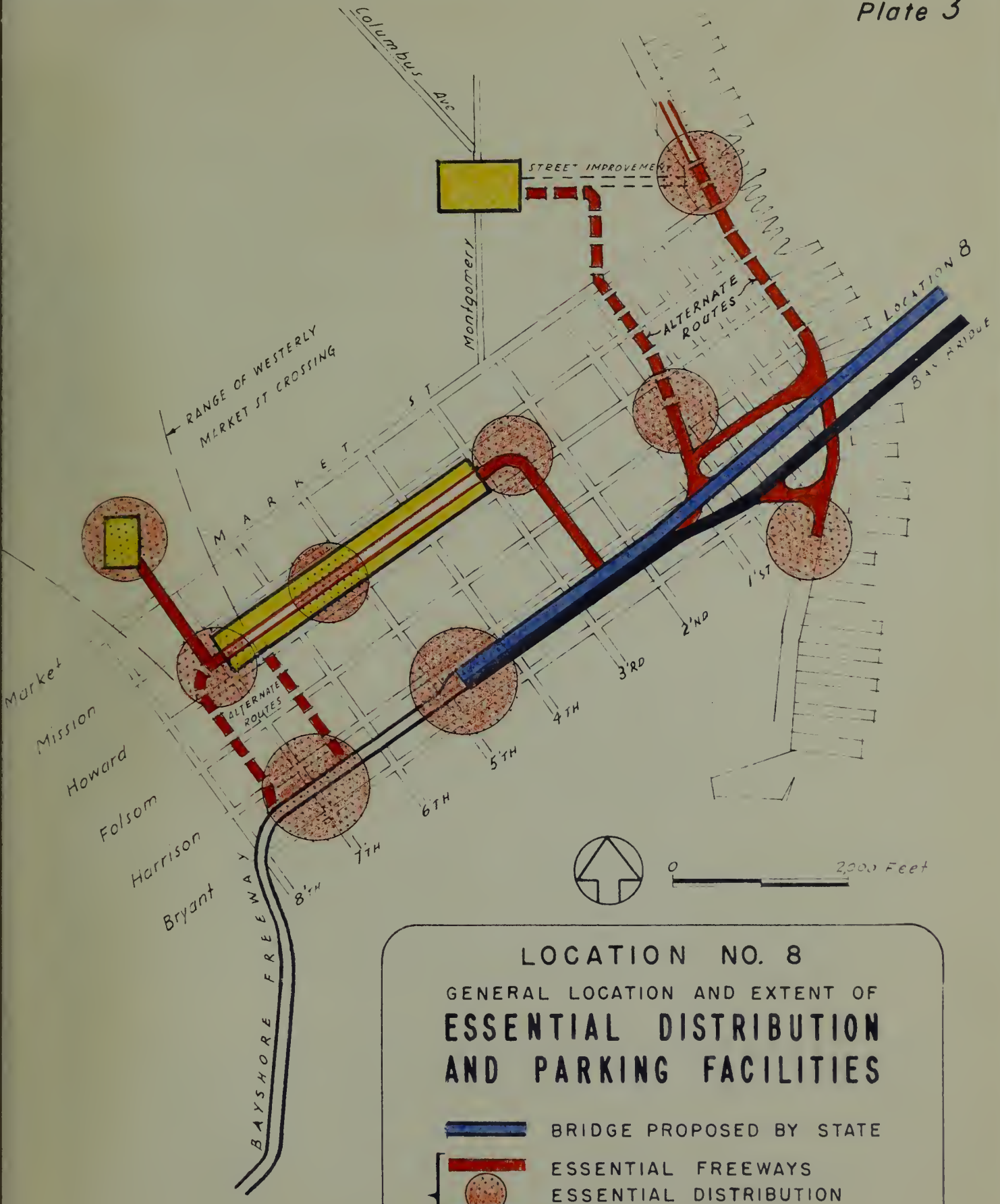
(f) Parking area, Blocks 208, 227, and parts of 207 and 228 not included in (c):

Land - $6,656,000. Total $ 6,656,000

Total Right of Way - $19,686,000
Total Construction - 13,037,000

Grand Total $32,723,000

Plate 3



LOCATION NO. 8

GENERAL LOCATION AND EXTENT OF

ESSENTIAL DISTRIBUTION AND PARKING FACILITIES

BRIDGE PROPOSED BY STATE

ESSENTIAL FREEWAYS
ESSENTIAL DISTRIBUTION
ESSENTIAL PARKING

POSSIBLE FUTURE FREEWAYS

DEPARTMENT OF PUBLIC WORKS AND CITY PLANNING COMMISSION OF SAN FRANCISCO

Nov 1946

3. PLATE THREE: LOCATION NUMBER 8, PARALLEL TO PRESENT BRIDGE

If the bridge is constructed parallel and closely adjacent to the present bridge, as shown on Plate 3, the problems of distribution from the double structure and from the Bayshore Freeway now being built are accentuated by the fact that all three will come into the same general area.

Multiple outlets from and entrances to thoroughfares leading in both directions would be required, carefully designed to distribute the flow evenly on all streets from Fourth Street to Eighth Street. The design must provide for easy interchange between the Bayshore Freeway and the Bridge into The Embarcadero in both directions, and also into city streets near Second and New Montgomery Streets. To make the proposed parking facilities near Montgomery Street and Columbus Avenue accessible would require either (1) widening of Washington Street and improvement of The Embarcadero south to the bridge connections or (2) extension of freeway construction on an alternate route across Market Street a few blocks west of The Embarcadero.

A more extensive parking garage loop south of Market Street, accessible from both the Bayshore Freeway and the Bridge, and suitable for express bus mass transit operation, is considered essential and is indicated diagrammatically on Plate 3. An elevated ramp extending from the dual bridge structure in the vicinity of Hawthorne Street (required in any case for street connections into Second and New Montgomery Streets) should be designed to make possible its use as an approach to this loop from the bridge.

Similarly, at the west end of the loop, a freeway extension toward and across Market Street to reach parking and street connections near the westerly edge of the Central Business District is necessary to avoid congestion on Sixth and Eighth Streets. Two alternate locations are shown, and further studies are under way to determine the most desirable solution. In any case, the design should be such as to permit connections with the parking garage loop.

Much of this development may be construed as a necessary part of the completion of facilities needed for the proper functioning of the present Bay Bridge. Doubling the capacity by a parallel bridge would make all these facilities essential as integral parts of the bridge approaches. That they would also serve to facilitate movements (usually in the opposite direction) of traffic to and from the Bayshore Freeway is an important, though not primary, consideration, as these facilities are needed for the Bridge traffic now.

If the new bridge is placed at any of the other locations discussed in the report, expecially at those locations south of Market Street, it is recommended that consideration be given to the inclusion of those portions of the above described facilities which are not constructed as a part of the Bayshore Freeway, for they are required now to correct deficiencies in the approach system of the present Bay Bridge.

Cost Estimate - Location Number 8, Parallel to Present Bridge

The following estimate of cost is based on a tentative location of the minimum facilities needed to serve the purposes described above:

(a) Connection from west bound 2nd Bay Bridge, (6-lane viaduct) to The Embarcadero and Washington Street with on ramp from The Embarcadero and Mission Street to Bayshore Freeway, and an off ramp to The Embarcadero and Folsom Street:

Right of Way - $ 5,794,000
Construction - 3,411,000

Total $ 9,205,000

(b) Off and on ramps to east bound 1st Bay Bridge from The Embarcadero and Brannan Streets, together with a viaduct from the said bridge in the vicinity of Third Street south of Bryant Street and along The Embarcadero to connect with proposed viaduct at Mission Street:

Right of Way - $ 3,406,000
Construction - 2,525,000

Total $ 5,931,000

(c) Surface connection along Washington Street from The Embarcadero to Columbus Avenue:

Right of Way - $ 2,893,000
Construction - 231,000

Total $ 3,124,000

(d) Connections to and from both bridges (3-lane viaducts) along Hawthorne Street ($2\frac{1}{2}$ St.) to parking area between Minna and Natoma Streets from 3rd to 8th Streets with off and on ramps at Howard Street:

Right of Way - $ 5,145,000
Construction - 1,815,000

Total $ 6,960,000

(e) Connection along 6½ St. (or alternate route) from Bayshore Freeway and bridge freeway extension to parking area north of Market Street:

Right of Way - $ 5,300,000
Construction - 2,200,000

Total $ 7,500,000

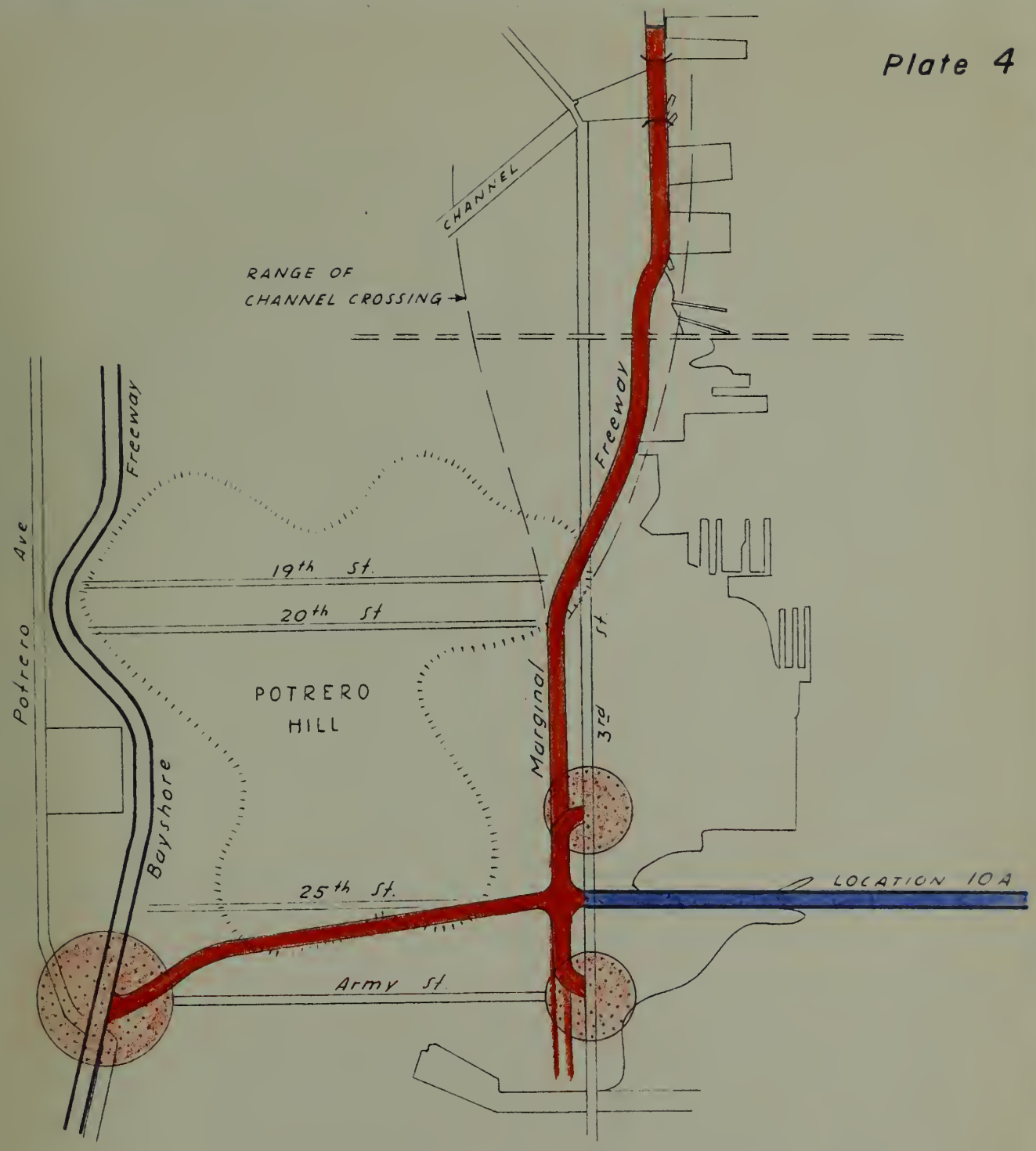
(f) Property acquisition only, for parking area bounded by 3rd and 8th Streets and Minna and Natoma Streets: (Estimated cost $5,000,000.) Total $ 5,000,000

(g) Parking area in Commercial District, entire Blocks 207, 208, 227, and 228: Cost - $8,600,000. Total $ 8,600,000

Total Right of Way - $36,138,000
Total Construction - 10,182,000

Grand Total $46,320,000

Plate 4



LOCATION NO. 10A

GENERAL LOCATION AND EXTENT OF

ESSENTIAL DISTRIBUTION AND PARKING FACILITIES

BRIDGE PROPOSED BY STATE

ESSENTIAL FREEWAYS

ESSENTIAL DISTRIBUTION

ESSENTIAL PARKING

POSSIBLE FUTURE FREEWAYS

0 2,000

Feet

Nov 1946

DEPARTMENT OF PUBLIC WORKS CITY PLANNING COMMISSION OF SAN FRANCISCO

4. PLATE FOUR: LOCATION NUMBER 10-A*, TWENTY-FIFTH STREET

Plate 4 shows the essential features involved in the proposed Twenty-fifth Street location. From this area two major streets, Potrero Avenue and Third Street, and two freeways, (1) the Bayshore Freeway soon to be built by the State Division of Highways, and (2) the Marginal Freeway proposed in the Master Plan, extend north and south. The bridge, therefore, would need only to be integrated with these four thoroughfares. The construction now of the portion of the Marginal Freeway between the bridge and The Embarcadero must be considered as an integral part of the approach facilities required at this location. Certain improvements necessary to complete the present Bay Bridge, as outlined for Location Number 8, would also be necessary. This would involve at least one freeway crossing, of Market Street and the provision of terminal parking facilities.

The connections to Third Street would have to be designed for integration with the construction of the Marginal Freeway. The extension to connections with the Bayshore Freeway and to the surface at Potrero Avenue would be an essential part of the bridge approach, and would function both ways as an interchange between the Bayshore Freeway and the Marginal Freeway. (Both freeways are elements of the State Expressway System as proposed recently in the Collier Report to the State Legislature.)

A possible later extension to Guerrero Street and the Mission Parkway (as proposed in the Master Plan) with connections via Army and Clipper Streets to Portola Drive would provide the widest possible distribution of traffic from this bridge approach to all parts of the City.

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* This location has been substituted for Location Number 10 because (1) it is substantially the same location but obviates the necessity of a tunnel, and (2) it more closely corresponds to the location recommended officially by the City and County of San Francisco to the Joint Army-Navy Board considering the need for and location of a second Bay crossing.

Cost Estimate - Location Number 10-A, Twenty-fifth Street

The following estimate of cost is based on a tentative location of the minimum facilities needed to serve the purposes described above:

(a) Connections from bridge to future Marginal Freeway on Tennessee Street with off and on ramps therefrom to 3rd Street at 22nd Street and at Tulare Street (all viaduct construction):

Right of Way - $ 450,000
Construction - 4,683,000

Total $ 5,133,000

(b) Connection to Bayshore Freeway, 6-lane viaduct from Tennessee Street to Pennsylvania Avenue, 6-lane surface freeway from Pennsylvania Avenue to 26th and De Haro Streets, 6-lane viaduct to Bayshore Freeway where the freeway provides a complete interchange to Army Street and Potrero Avenue:

Right of Way - $ 200,000
Construction - 2,217,000

Total $ 2,417,000

(c) Connection from section "a" mentioned above, at 23rd Street to The Embarcadero at Berry Street; consisting of a 6-lane viaduct, crossing Channel Street at Sixth Street thence along Berry Street to The Embarcadero:

Right of Way - $ 2,000,000
Construction - 13,100,000

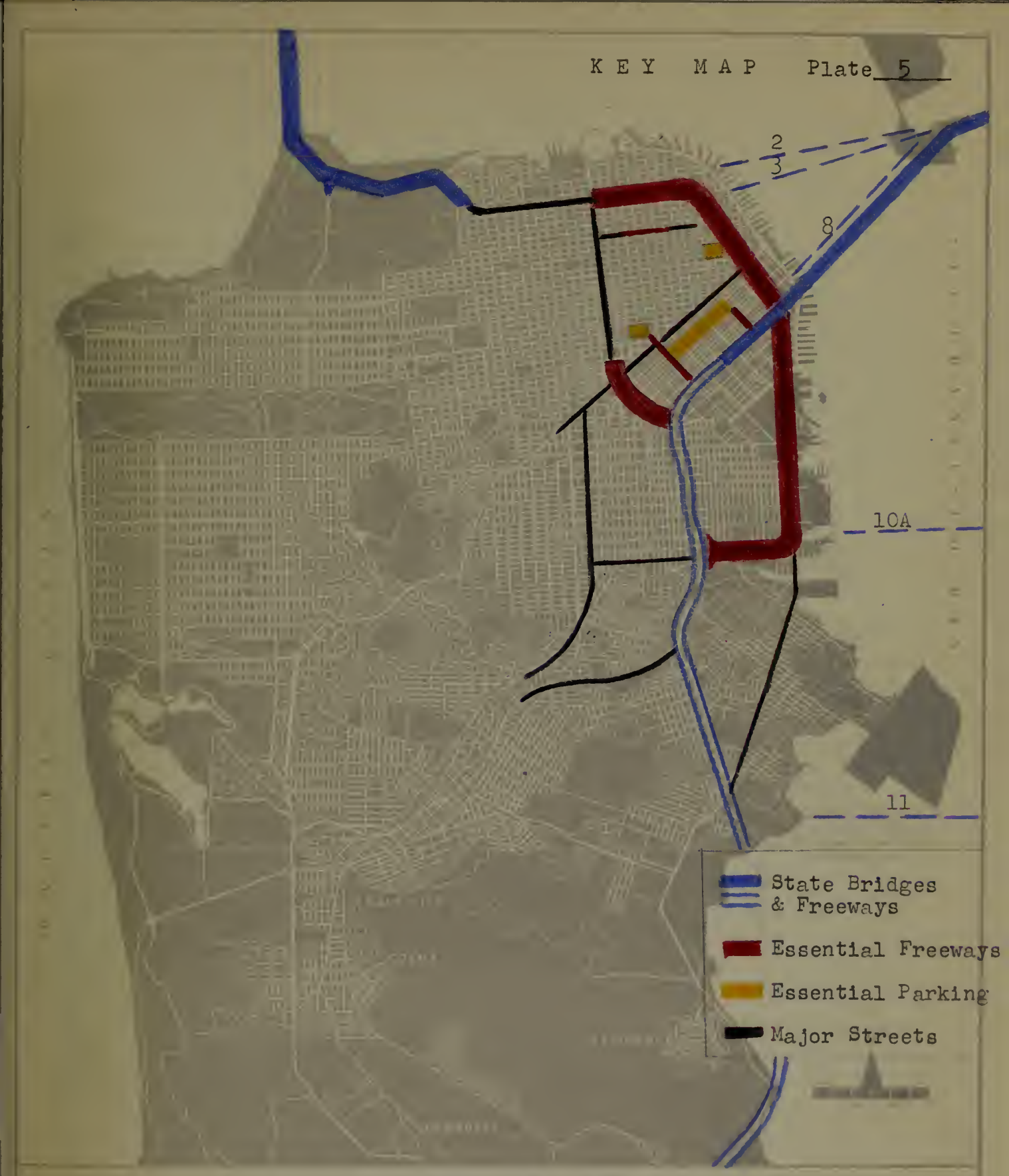
Total $15,100,000

Total Right of Way - $ 2,650,000
Total Construction - 20,000,000

Grand Total $22,650,000

LOCATION NUMBER 11: CANDLESTICK POINT

Here the bridge would lead directly into the Bayshore Freeway and the City's problems would be somewhat the same as those mentioned in connection with the location parallel to the present Bridge (Location Number 8) except that the costs are not so clearly chargeable to the bridge. Connections to the Marginal Freeway would be conditioned on tideland fill projects. Diversion of some traffic from the Bayshore Freeway, which the bridge at this location would overload, into the proposed Mission Parkway by a cross-over through or around the edge of Bernal Heights might be required, but this too would appear to be an intra-city project rather than a project chargeable directly to the bridge.



System of

EXISTING AND PROPOSED THOROUGHFARES

DIRECTLY RELATED TO THE SECOND BAY CROSSING

SAN FRANCISCO AND ENVIRONS

SAN FRANCISCO CITY PLANNING COMMISSION

III KEY MAP AND BASIC FACTORS FOR ALL LOCATIONS

Consideration for three basic circulatory needs has governed the study given in this report to the approach requirements of each proposed bridge location. The City is agreed that:

1. The Marginal Freeway, or a suitable alternate, looping the eastern and northern sides of the densely populated working and retail districts is a primary link of immediate importance in the circulation pattern of the City, and that the portion from Lombard Street and Van Ness Avenue to Army Street and the Bayshore Freeway is necessary now to accommodate vehicular traffic from the east, north, and south.

2. A freeway link from the Bayshore Freeway and the existing Bay Bridge across Market Street to Van Ness Avenue is equally important as a traffic thoroughfare circling the western side of the Central Business District.

3. That parking terminals south, west, and north of the Central Business District, with adequate connections to the Bridge and the freeways, are necessary to accommodate vehicles whose passengers are bound for the Central Business District. A necessary complement to this facility, which the City must provide, is a system of Business District bus transit loops linking the parking terminals with the heart of the Business District.

The above described facilities are deemed to be absolute requirements if the City is not to be paralyzed by the increasing volume of vehicular traffic flowing into its central area. A second Bay crossing can be of value in providing easy transbay circulation only if its approaches can freely accommodate the volume of traffic carried on the bridge itself. The three facilities described above are considered as absolute minimum facilities required to alleviate the present vehicular congestion in the central area of San Francisco and to accommodate an additional concentrated flow of traffic from a second Bay crossing. Whichever bridge location is selected, the basic factors and needs described above and shown on the key map must be applied to the final solution.